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METHODOLOGY IN PHYSICS AND PSYCHOLOGY WITH PHILOSOPHIC IMPLICATIONS

Part I

THE methodology of scientific inquiry is undergoing significant change. This means that our interpretations of natural phenomena are changing correspondingly. For our methodology will be closely adapted to our ideas about nature, i.e., our science.

The recent tremendous advances in the science of physics might well be anticipated to exhibit new phases of methodology and if there is anything common to the methodology of the various sciences the new views of methodology in physics should be at least suggestive to all kinds of scientists.

One of the most striking aspects of the history of scientific thought is the way in which the greatest insights have been distorted, confused, misinterpreted, and to some degree discredited, by the company they have kept, in consequence of having been incorporated into systems or schools of thought that were dominant at the time that these significant insights were first brought to the world's attention.

It would seem that the surest road to a new methodology of physics would be found in the fullest criticism of all the great insights of science and philosophy. When by this process these great insights shall have been freed from the narrowness and misunderstanding incident to their history, they may be combined to the end of constructing a foundation for the most promising methodology possible to us at this stage of scientific and philosophic evolution.

Professor Wilhelm Ostwald in the early 'nineties was attempting to interpret to his students the methodology employed by J. Willard Gibbs in thermodynamics. At a time when Tyndall was writing "Heat as a Mode of Motion," Gibbs was treating thermal phenomena independently of mechanical concepts. Ostwald was wont to remark in those days that if physicists had investigated heat phenomena before the mechanical, we would have, not a mechanical theory of heat, but a thermal theory of mechanics. The idea conveyed to some of Ostwald's students was that mechanics had no logical priority over heat in any assumed hierarchy of sciences. In other words, the idea of Gibbs and Ostwald seemed to be that there is no hierarchy of sciences, at least none with mechanics as its base, and

that the many kinds of process in the physical science, thermal, optical, electrical, chemical, can not be reduced to mechanics. It is a question whether Gibbs ever expressed such an idea. But Gibbs' work, as interpreted by Ostwald, implied just that. But this insight of Ostwald's never had any fair opportunity to justify itself; for the reason that it came to be associated with another idea of Ostwald. He dreamed of what he called a hypothesis-free science. The atomic hypothesis became his *bête noire*. The atom was conceived in mechanical terms. If physical science could not be reduced to mechanics, then the atom must be doomed as a fundamental reality in the structure of the universe. But it was not long before the atom in the form of an electron was achieving its most spectacular career. Ostwald admitted the defeat of his idea and with its downfall the great insight which he had discovered in Gibbs was also almost lost to view.

But the electron which Ostwald viewed with so much suspicion partially took sides in favor of his interpretation of the significance of Gibbs' methodology. The determination of the mass of the electron raised the pertinent question, is all of its mass electromagnetic? As an affirmative answer to this question became even clearer the mechanical explanation of electrical phenomena was displaced by an electrical explanation of mechanics. The idea was still dominant that everything must be reduced to just one thing. The original insight of Ostwald that there was no logical priority belonging to any one type of physical phenomena over other types was not readily grasped. That idea has perhaps appeared most clearly in the teaching of Professor Arthur C. Lunn. As mechanics lost its long-acknowledged priority progressively in the minds of all who deal with physical phenomena the idea of Lunn became more and more plausible. There is no question that the beginner in physics can start his work with the electric circuit, with heat or with mechanics. He can learn to measure electric current independently of the measurement of any other measurable whatsoever, independently of the measurement even of time or distance. Equally well he may measure mass independently of the measurement of anything else. It is even possible to measure heat energy, entropy, and temperature independently of the measurement of any mechanical space or time measurable. Ostwald's insight into the meaning of Gibbs' procedure is fully vindicated.

The procedure for the development of a philosophical foundation for some new phases of scientific methodology will begin as suggested above with an attempted rescue of some of the great scientific and philosophic insights from the obscurities inflicted upon them by the strifes between schools of thought.

The first insight which calls for this kind of treatment in this connection is that methodological one upon which specialism is grounded. This one is selected for first treatment because of its obvious relation to the Ostwald-Lunn-Gibbs insight already set forth. That view of things makes possible the breaking up of a science like physics into many separate sciences, mechanics, electricity, heat, etc. Each one of these may receive quite an extensive initial development independently of the others. This is the very essence of specialism. One may know much about electricity without knowing everything else. The specialist's ideal is to know something without knowing everything. The specialist has accepted the proposition that it is possible for him to devote his life and thought and activity to some very restricted field. But few specialists have ever stopped to consider whether the possibility of specialization, universally admitted, throws any light itself on the structure of the universe. If he did, it is entirely possible that he would be led to view specialization in a way quite unexpected. The specialist has accepted specialization unreflectively, as a postulation, taken dogmatically, and he himself has been contemptuous of any meaning or implications that it might carry. To his mind it has been, like all postulations, an absolute ultimate. But science today is making much of its progress by calling on "absolute" ultimates to acknowledge their relativity and to yield up their implications and in general to give an account of themselves.

In the case of the postulate embodied in the universal assumption of the possibility and legitimacy of specialization we may clearly see that this dogmatic assumption acquires a new meaning and a more thoroughgoing character when it is identified with the Ostwald-Gibbs insight. Specialization is possible because the universe is constructed in such a way that the initial steps in any research may be taken independently of any other scientific developments, and the research, while later pursued with a full sense of relationships to other fields, maintains, throughout, its own definite independence. Thermal phenomena never suffer *reduction* to mechanical. Mechanics never is *reduced* to geometry. Biological phenomena are never reduced to dynamics, nor psychology to physiology. Of course, the psychologist may interest himself in some correlations between the fields of physiology and psychology. But that makes of him a broader specialist, something like the physical-chemist, originally viewed with undisguised suspicion.

It will next be illuminating to examine one of the greatest insights in the history of science, that of Democritus and Dalton, the very fertile idea of the atomic constitution of things. The course of scientific development itself has removed this great insight from the

pent-up narrowness of its original conception. The idea of the atom was threatened with annihilation until the general atmosphere of relativity enveloped it and promised a new life of much enlarged fruitfulness. When J. J. Thompson found the mass of an electron about one two-thousandth of the mass of the smallest known atom, hydrogen, the idea gained currency that the reputedly indivisible had been divided. As the atomic view had been submerged in the generally popular philosophy of absolutism, making the atom absolutely indivisible, many jumped to the conclusion that the atomic view of nature had been exploded. But no. At first the old atom had merely been exchanged for a new one. The electron, which succeeded, was full inheritor of all the prerogatives of absolute indivisibility. But today the Schroedinger electron is not the absolutely simple and indivisible thing thus supposed. For it may be thought of in terms of its parts, viz., waves. Thus in the end quite a different thing had happened to the atom from a mere transfer of absolute indivisibility to a new object, and the idea of atomicity was not exploded, for the old chemist's atom continued to play its former rôles in the same useful and fruitful ways. It still preserved all the atomicity that anything really needs to have in order to meet scientific specifications. It is relatively indivisible, not absolutely so. Relatively to certain processes the chemist's atom is indivisible, relatively to other processes it sheds its electrons and becomes a stripped atom.

The world appears to be organized on the principle of relative atomicity. Every activity in the universe is a function in some whole having relative atomicity. An automobile is a complex of activities, unified, originating in the explosion in the cylinders behind the pistons and directed to the contacts of the back wheels with the road. It is a unified structure permitting this complex of directed activities to take place. The electric circuit has an activity originating where armature conductors are cutting magnetic fields and directed to some part of the whole circuit's structure, say a lamp, from which luminous radiations are to emerge.

The organization of the world is certainly atomic. There are the chemists' and the physicists' atom, the biologists' atom, the living animal and plant cell, the animal organism, the pendulum, the electric circuit, the solar system. For to be an atom means nothing as regards size. It means only relative independence, unity, and indivisibility. The man of ordinary common sense finds his life activities constituent of many kinds of atoms, the automobile, the going concern that he calls his business, his family, and his government.

The atomic insight, thus freed from its original narrow implica-

tions, gives meaning to the specialistic insight and to the Ostwald-Gibbs insight. Specialization is possible because nature is built atomistically. The science of the electric circuit may be developed independently of that of mechanics because the electric circuit has the independence, the unity, and the relative indivisibility of an atom.

It is important to get some detailed idea of how any given atomic whole is analyzed when we follow a methodology based on the Lunn-Ostwald-Gibbs insight. We will proceed to give this with just sufficient detail to make the procedure clear. It will be observed that measurements are made with the main reliance upon a definition of the measurable and a very limited dependence upon instruments and that the definitions of these measurables are suggested to the experimenter by letting the circuit speak for itself and reveal the character of its own behavior, and that the measurements finally obtained have a certain very limited independence, and that the nature of the limitation of this independence will need to be carefully outlined, and that when instruments have been calibrated to measure these measurables the latter show empirical relations with one another in harmony with the expectation which one would have from the way they were originally defined in terms of the whole and of one another. It is also to be noted that this electric circuit tells its own story to the experimenter in terms of secondary qualities, in this case the color of glowing lamps. Through the play of these secondary qualities the definitions of the measurables are suggested and the measurements when made appear as the dimensions of the secondary quality of certain bodies, viz., lamp filaments. The elements of the analysis have only that independence of the whole to which they belong, which is barely sufficient to permit the investigator to know some one thing at a time and not force upon him the impossible necessity of knowing everything about this atomic whole all at once. The relations of the elements analyzed out of the whole *in situ* are functional to the whole and to each other, sufficiently so to enable the whole to be called an organic mechanism, to use Whitehead's term. The most independent elements are the bare abstract numbers that constitute measured values and their independence is extremely limited and relative. Each of these items is a significant step in the methodology and important for the discussion of the following pages. This fact justifies a brief account of the following character.

With a view to developing some scientific ideas about an electric circuit we may do a number of very obvious things to it in the way of experiment. We may have available a number of such circuits, having a variety of characters. We may also have a number of differ-

ent kinds of lamps. If we insert, say, ten of a certain kind of lamp, which we will call *D* lamps, in one row or series in this circuit, we shall find them glowing with a yellowish-red light. If we cut out of this series one lamp, two lamps, and finally five lamps successively we shall find the lamps remaining giving more and better light, until five lamps are left in series, they glow with a white light and look as lamps ought to look when used in the normal way. If these five lamps are put into a second circuit they will glow with a reddish-yellow light. As lamps are successively cut out of the circuit, the illumination will improve until, when only one lamp is in series, it will glow with white light of the normal brilliancy of electric lamps. Now if five lamps of a kind which we may call *E* lamps are put in series in this circuit, it will be found desirable to cut one lamp out, leaving four, in order that the remaining lamps may glow with their normal white light brilliancy. If one *E* lamp is put into the third circuit it will show normal white light brilliancy.

Now the following quite obvious conclusions will be drawn from observation of the visible consequences of trying these obvious experiments upon lamps and circuits. Circuits have different electric lengths. Lamps have various electric lengths. If we take as our unit of electric length, the length of a *D* lamp when it glows with normal white light brilliancy, then the first circuit is five *D* lamps long, the second, one *D* lamp long, and the third, one-quarter of a *D* lamp long, or one *E* lamp long.

Now we may put into the first circuit three rows or series, four rows or series, or almost any other number of series of five *D* lamps in each series and all the lamps will glow, so far as eye can judge, with normal white light brilliancy. We may say that this circuit is 5 *D* lamps long and 1, 2, 3, 4, 5, *D* lamps wide. We would find that we could not increase the number of rows of *D* lamps indefinitely without finding the lamps glowing with something less than normal white light brilliancy. Every circuit then has not only a definite length but a limiting width. When we have four rows, say, of *D* lamps with five in a row, or series, we may note that each series is just as long electrically as every other. That is to say as we move our attention across the circuit from one row to another we will observe that the circuit has the same length everywhere across the circuit. And that it has the same width of four *D* lamps everywhere along the circuit. This observation seems very commonplace until we try to give the circuit different lengths in different rows across the circuit. If we try to make one circuit eight lamps long we shall get something less than normal white light brilliancy in that row. If we try to make it four lamps long instead of five we shall get something more than normal brilliancy,

and if we should leave the lamps for any length of time in such a circuit their usefulness would be rather rapidly impaired. The attempt to make the circuit longer in some latitudes across the circuit fails to give us anything that we may be sure of as being electrically longer. In the same way we fail to get a greater electrical width in some longitudes along the circuit than in others by a similar experiment. When we try to make the circuit more than five *D* lamps long the lamps are dimmer. When we try to make the circuit wider in one longitude than in others the lamps are also dimmer in that longitude. The most obvious guess about it is that trying to make a circuit five *D* lamps wide in one longitude, when it is only four *D* lamps wide in other longitudes, results in keeping the circuit still the same number of lamps wide everywhere. The five *D* lamps across the circuit divide the four *D* lamps of width among themselves, acquiring each something like four-fifths of their normal electric width. Increase of the length combined with consequent dimness leads to the conclusion that when a lamp glows with less than normal white light brilliancy both its electric width and its electric length become less than normal width and length. Other experiments will be suggested by these conclusions, leading to other interesting results.

These experiments lead to the idea that there is something that is measured along a circuit that is the same everywhere across the circuit, and something that is measured across the circuit that is the same everywhere along the circuit.

This surmise may be validated in some of its particulars by doing a number of very obvious things with the circuit. Any kind of effect will be found to repeat itself precisely everywhere along the circuit provided the only change made in the circuit is to move the heating coil, the lamp, the electromagnetic instrument, or the electrolytic cell to various positions along the circuit. There is obviously something that is the same everywhere along the circuit. And that obviously same thing may be indicated and later measured by any kind of instrument, electromagnetic, thermal, electrolytic, or mechanical.

The next step is to base these conclusions on something more precise than the judgment of the eye. To this end we must use some kind of an instrument. In order to use the ordinary electromagnetic instruments as means to developing measurements of the circuit it is not at all necessary to understand the construction or theory of those instruments. A watch may be used to measure time by a man who knows nothing about its internal construction. So the dimensions of an electric circuit may be measured by using ordinary ammeters and voltmeters without knowing anything about

their action. For the width and length of a circuit, which will turn out to be nothing but so-called "current" and "voltage," are measured not by instruments so much as by the definition already given for electric width and length. But before these instruments are ever used for the purpose of accurate measuring they must be used as mere indicating instruments showing when the circuit at one time is in the same identical state as at another time.

We may take quite a powerful incandescent lamp. Place a so-called ammeter in series with it. As the lamp occupies most of the length of the circuit there may be no danger to the ammeter. In parallel with the lamp a more delicate ammeter, a so-called millammeter with a rheostat in series with it, may be placed. This arrangement constitutes a so-called voltmeter. It has already been learned that a rheostat takes up the length of a circuit, leaving only a little length to any instrument in series with it. This insures the safety of the millammeter. A radiometer is placed, say, a meter away from this lamp. Every time the rheostat in the main circuit is adjusted until the lamp glows with a certain brilliancy and the radiometer shows a certain number of revolutions per minute, every time these exact conditions are repeated the ammeter and voltmeter will show precisely the same pointer readings they showed at other times when these conditions held. In other words these instruments can be depended on to *indicate* the same values by their pointer whenever they are placed in a circuit with the same electrical conditions prevailing in it. This is the use of these instruments as indicating instruments before they are ever used for measuring. This kind of reliability in these instruments is sufficient when used under the guidance of the above definitions of the electric width and length of a circuit to enable anyone to calibrate so-called ammeters and voltmeters for the measurement of the electric width and electric length, current, and voltage of circuits, with precision.

To this end several ammeters are connected in a circuit in series. The rheostat is adjusted until one instrument's pointer points to a mark which indicates what we are going arbitrarily to choose as our unit of width. Then, since electric width is by definition the property of a circuit which is everywhere the same along its length, we are going to observe the readings of each instrument in series and say that whenever these instruments give the present reading in any circuit they indicate the width of one unit, which we will call one ampere. The second instrument may read 35, and the third 4, but each of these readings means one ampere. Then we will put a number of these instruments in branch circuits in parallel one with another. We will adjust the rheostats in each one of these branch circuits until each instrument indicates a width of one ampere.

These parallel instruments will be in series with one other ammeter in the main unbranched part of the circuit. Whatever the latter reads will be taken to mean two, three, four, five, or whatever is the number of branch circuits in series with it, each having one ampere width. We must say this, for the definition of width already adopted asserts that electric width adds across the circuit and is everywhere the same along the circuit. In this way ammeters may be calibrated to measure any number of amperes, or fractions of amperes. The width of any circuit in amperes may now be measured. The measuring process is absolutely independent of the measurement of any other measurable. And the measuring process is carried out largely through the instrumentality of the definition of the thing measured more emphatically than through the instrumentality of the instrument. (Any kind of an instrument will serve the purpose, but the only one definite definition.) This definition describes the operation of measuring, and the object of measurement has so far no obvious meaning except that contained in the definition itself.

By similar methods voltages may be measured in accordance with the definitions of electric length already given and they may be measured independently of the measurement of electric width. By means of certain very obviously suitable experiments we may arrive at a definition of a quantity that obviously relates electric length and width to geometric lengths and widths of conductors. We shall find that we shall have thus defined the same quantity that is called resistance. By means of this definition and a variety of coils of wires we may calibrate these coils by means of which we may measure resistance, independently of the measurement of electric width (current) and electric length (voltage).

We are not yet sure that there is in nature any such things as electric length and width or electrical resistance as we have defined them and measured them. But we do know that if there are such things as defined we have measured them in accordance with their definitions. These definitions were suggested by experiments with the lamps which had no greater precision than the judgment of the eye permits. We shall now find, however, that these three quantities have the following invariable relations to one another by any easy experimental verification.

$$V \text{ equals } RI,$$

where V is the voltmeter reading across a resistance R, and I is the ammeter reading in series with it. Whether our measurements are measurements of realities or not, these measurements, measured wholly independently of one another, show an unexpectedly simple and invariant relation such as we expect in a law of nature. It must be strongly emphasized that they do not acquire this relation

through any definition of V, R, or I. The relation is empirically discovered after V, R, and I have been measured each one independently of the measurement of the others.

Later we may heat a certain vessel of water that contains one definite volume of water as indicated by the fact that it has been poured from some full vessel taken as unit of volume, from a temperature indicated by a certain mark on a thermometer to a certain other mark on the thermometer, in the time indicated by the movement of the minute hand of a watch a certain number of times over its dial. We may then heat water obtained by emptying in the unit volume of water twice, over a temperature interval between the same thermometer marks and during an interval of time indicated by the movement of the minute hand the same number of times around its dial.

In the second case we shall find the product of VI, the electric length by electric width just double what it was in the first case. In other words we find that the product of electric width by electric length, as defined and measured, measures the quantity of that secondary quality of bodies usually interpreted as heat sensation available from the heating coil in the circuit under the given conditions. We had had reason to suspect that the electric width multiplied by the electric length measured the quantity of luminous sensation available from lamps in our preliminary experiment with lamps. This surmise can be also fully verified. In the above test non-measuring instruments are used except ammeters and voltmeters. All the other instruments, thermometers, watches, are merely indicating instruments. They are not used as measuring instruments. They merely indicate identity of conditions in two situations.

The length and width of the circuit, the so-called current and voltage, are the dimensions of something. We have taken the most obvious thing that they could be conceived as measuring, viz., the secondary qualities of matter, heat and color. Secondary qualities belong to psychology, not to physics, is the traditional belief. There may be something coming out of the circuit that is able to cause sensations, but these latter exist only in the sentient organism, not in the electric circuit itself, according to the prevailing view of such matters. Therefore we shall be bidden to find something else as the real object of these measurements. The idea that they measure secondary qualities and that these secondary qualities are out there in the electric circuit is too naïve, too much like the ordinary common-sense view of the world. The world of the physicist is quite different from that. The scientist, like the philosopher, has felt a great delight in thus building a world utterly foreign to ordinary common sense. And by refusing to interpret his measurements as measure-

ments of something as obvious as the secondary qualities of physical bodies he has built a most fantastic kind of world and introduced unlimited and ever increasing confusion for himself, the common man, and the philosopher, and he has been led by his distorted imagination to go on long quests to discover physical objects like the ether and the atom without secondary qualities.

It might be said that in measuring current we are measuring a stream of electrons. The beginner can not say that from any experiments he has performed, or has seen performed. And perhaps by the time he lives to see such experiments performed another theory of current may prevail. We may avoid the idea of measuring secondary qualities and so perpetuate the traditional confusion. In that case voltage is merely a *something* that is everywhere the same across the circuit and adds along the circuit, and current is *something* that adds across the circuit and is the same everywhere along the circuit. These definitions are the very essence of the operations of measuring. They are merely *somethings*. They certainly have no sensuous content and they have no other content except a purely relational content to other somethings equally devoid of any content except their relations to other equally empty somethings. A world of somethings meaning nothing but their relations to other somethings would collapse for lack of something real for the relations to relate. Or it may be assumed that these somethings have a content of their own, but that it is unknown and wholly mystical. In that case these measurables may become eternal objects, to use Whitehead's term, and dwell in a Platonic Heaven from which they sally forth to make ingression into a time-space continuum, a world of point-time events. Bewildering has been the variety of fantastic philosophic speculation indulged in in order to avoid the obvious interpretation of what we measure, viz., secondary qualities of physical bodies. But the situation is a difficult one for the physicists aside from any philosophic speculation. The difficulty has been created by certain postulations that Galileo made in the infancy of science. Galileo made these postulations under the influences of platonic philosophy. Naturally they have led to Whitehead's platonic interpretation of physical things. But before we consider what Galileo did it will be well to stop and view the whole situation, being strikingly of the same character as that which we have just been viewing in the case of our study of the electric circuit.

The traditional idea of the physicist has been that we are measuring dimensions of some physical reality utterly devoid of secondary qualities, physical objects like atoms, electrons, and the ether being only the primary qualities of matter. This view has dominated physical science, making the physicist's world utterly inconceivable

to common sense. How these two worlds contrast will be brought out in Part II of this paper.[1] Also the Galilean postulation regarding secondary qualities will be stated and some of its consequences developed, leading to a *reductio ad absurdum*. The proposition will then be advanced that we may escape the absurdities of this outcome by adopting the obvious interpretation of the methodology set forth in Part I of the paper.

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THE MEANING OF PURPOSE

PURPOSE is a principle used for interpreting the sequence of events. Although this principle has at times been considered as all important, and at other times as of no significance at all, its meaning has usually remained vague and indefinite. So, before raising the question of the adequacy or applicability of purpose to life or to mind or to any other realm, it is necessary to determine its specific meaning.

Like other major principles or concepts, purpose has acquired varied and even conflicting meanings. To find a common ground of understanding in the confusion of interpretations the simplest procedure would be to analyze the major aspects of the instances of purpose. Certain processes are usually considered as purposive; if we could describe the characteristics of these processes we should be able to arrive at an intelligible definition. The method we shall employ will therefore be, in the broad sense of the terms, descriptive and empirical.

The most obvious illustration of purpose is the use of tools, instruments, and machines. The purpose of a saw is to cut, of a musical instrument to produce sound, of a motor-car to transport. Purpose is also employed in biology. The purpose of living beings, we quite often say, is self-maintenance. The function of the eye is to see; the function of the heart is to propel the blood. On the human level of action the use of the concept of purpose is also very common. The purpose of a physician is to cure illness, the aim of a teacher is to instruct students. In referring to particular acts it is said that one throws bait to catch fish, or that one is going to town to transact business. We now have a sufficient number of varied illustrations of purpose to analyze its nature.

Let us first note that in each illustration the purpose of an act or object is observable in the results of that act or object. The purpose is to produce sound, to cure illness, or to transact business. Here,

[1] To appear in the next issue, No. 5.

however, an important question arises. What particular result should be considered the purpose of the act? Acts have innumerable consequences, and unless one has a principle or technique of selection, it is impossible to distinguish between the result that is the purpose and the consequences that are merely accidental. In throwing bait to catch fish the results of the act, if pursued, are infinite in number. Why is it that we consider a particular result, viz., the catching of fish, as the purpose of the act rather than the other consequences?

The principle by which one must select the purposive result must evidently be different from the principle of mechanism. In purposive explanation the cause and effect relation is changed to the means and end relation, and this relation, to remain distinct from mechanism, must either add or leave out something. How, then, shall one determine the purposive result?

The purposive result, in the ordinary conceptions, is determined in terms of foresight, prevision, or conscious desires. The idea of what one wants comes first, and action brings this idea into concrete existence. The antecedent foresight or desire is called purpose, and the result the fulfillment of purpose. A more precise statement of this view is given by Professors Baldwin and Stout: Purpose is "a project which is adopted for execution but not yet executed."[1] Similarly, McDougall considers purposive action as that action "which is governed . . . by prevision of that which still lies in the future, of events which have not yet happened, but which are likely to happen."[2] The principle, according to these authors, which will distinguish the purposive result from accidental consequences, will be the correspondence of the result with the prior project or prevision of the individual acting.

That there are preconceived purposes we do not question, but we find this interpretation of purpose to be too narrow. In the first place, purpose as prevision is inapplicable to plants and animals, where purpose is constantly being used. No one, we guess, would argue that the blossoming flowers or the self-maintaining living organisms have prevision or preconceived plans in the fulfillment of what we take to be their functions. Purpose as prevision presents, also, an inadequate account of certain types of human action. Our voluntary actions, e.g., which are usually considered to be purposive, are fundamentally expressions of deep-seated tendencies rather than consciously anticipated processes. And, again, we often act under the influence of a growing purpose of which we become aware at a comparatively advanced stage of our action. It is a familiar fact of experience that we "often learn what our purposes are for the first

[1] *The Dictionary of Philosophy and Psychology*, Vol. II, p. 404.

[2] McDougall, Wm., *Outline of Psychology*, p. 48.

time by the pain which attends their defeat."[3] Even higher forms of action can not be adequately described in terms of antecedent plans. A creative work grows and develops in its execution; new suggestions and possibilities occur, and the final result can hardly be described as the realization of a preconceived plan.

To restate the question, how shall we empirically distinguish the result that is the purpose of an act from the accidental consequences? Our description or classification of events must in some way differ, as we earlier remarked, from the mechanical description; otherwise purpose would have no distinctive meaning. And, again, as we pointed out, the definition of purpose in terms of prevision or preconceived plan is too narrow to be an adequate principle for all instances of purpose.

The problem might be simplified if we pointed out the way one describes causality. Causality as the action of a force or power can not be observed. What one observes in causality is a certain sequence of events. Fire causes warmth, water quenches fire; a billiard ball strikes another, and the second ball moves. Empirically causality means a relation in which, given the condition, the phenomenon in question follows, and, removing the condition, it ceases to follow. More accurately stated it is the functional correlation of variables. The description of purpose is in very much the same case. Empirically, in purposive processes one does not observe the activity of a force or a conscious power. What, then, does one observe? In every illustration of purpose which was mentioned what one observes is an act or object which proceeds towards a result. Towards what result? Towards the common result of that type of act or object. Musical instruments produce sound, hearts propel the blood, physicians cure illness. In each case there is a common result which is usually, though not always, accomplished. Acts which have completely unpredictable results escape purposive description. For the empirical treatment of purpose one must observe a certain common tendency or routine. Apart from the common tendency of a type of act, one has no data to anticipate the end towards which an act proceeds, and no basis to distinguish between the result that is the purpose of the act and merely accidental consequences. Purpose, unlike causality, is not an invariable succession of events, and, unlike casual occurrence, is not indeterminable; it is a common tendency of a type of act which happens for the most part. If, in the consequences of an act one should discern a common routine, he should consider that to be the purpose and regard the rest as accidental. The purpose of a given seed we assume to be its growth into likeness of its parents. But how do we know this? We know this as Morgan describes it, by "the study of life-history in a series

[3] Taylor, A. E., *Elements of Metaphysics*, p. 55, note.

of affiliated individuals *m*, *n*, *o*, and *p*. Such study reveals routine. We find that in them the tune of development is played again and again *da capo*. And having learnt the tune in *m*, *n*, *o*, and *p*, we foresee the sequence of the organic melody and harmony in *q* as soon as a few chords have been played. Then we can say that the opening bars are significant of the whole piece—may even say that the simple organic ditty of *mucor* or the complex symphony of *quercus* is the end for which the opening bars of development exist."[4]

Purpose, as we have described it, can not be observed in separate parts of a system nor in isolated results of an act. Purpose is a quality which belongs to a group. "Teleological science," as Professor Singer puts it, "must deal with principles that apply to the individuals of a group collectively, and not distributively."[5] Distributively, in the analysis of living beings one finds nothing but physico-chemical elements, but collectively one discerns a common tendency for self-maintenance.

Before a final definition of purpose is presented one further point must be considered. The concept of a common tendency or common result is not a sufficiently exact expression to be the basis of a definition of purpose. There are cases where, though the result falls far short of being the common tendency, one still considers it to be the purpose of the act. The purpose of seeds is to grow into parent trees, but actually a very small number become trees. It would be well, therefore, to substitute the expression "expected-result" for the expression "common result," leaving to statistical studies the determination of the percentage of the tendency in each purposive class. We may now define *the purpose of an act or object as the expected-result of that class of act or object*. The expected-result, it should be noted, is the anticipation of the *observer* who interprets the activity, because of prior acquaintance with certain routine, as proceeding towards a consequence. It is only in certain types of purposive activity that the result may also be anticipated by the individual acting.

We will now attempt to clarify our general interpretation by analyzing its implications and characteristics.

1. *Expected-Result.*—The most important characteristic of our

[4] Morgan, C. L., *Instinct and Experience*, p. 244.

[5] Singer, E. A., *Mind as Behaviour*, p. 68. We owe our general conception of purpose mainly to the writings of Professor Singer and wish to acknowledge our indebtedness. For the relation of purpose to group concept see also Goblot, E., *Traité de Logique*, p. 344. "Une fonction est un processus complexe, une série de phénomènes enchainés. Pour la comprendre, il ne suffit pas d'en considérer séparément tous les termes: l'analyse montrera presque toujours que chaque terme est ou mécanique, ou physique, ou chimique. Il faut la considérer aussi dans son ensemble."

definition of purpose is the expected-result. Out of an infinite number of consequences of an act the common tendency, or the expected-result, is selected as the purpose of the act. This result, in the first place, is the unifying principle of the series of events or objects in the purposive whole. Events or objects in their isolation have no purpose, but in relation to a common result they acquire unity, meaning, purpose. The separate parts of a violin and bow are so much wood, gut, and horsehair; but in reference to their common function they become the sounding-box, the bridge, the *g*, *d*, *a*, and *e* strings, and the bow, and they work in unison to produce a certain kind of sound.

The expected-result is also the drive of action. Purposive actions are set in a certain direction and they persist until they attain the result or are defeated. The attainment of the result functions, therefore, both as the unifying and as the driving principle. A hunting dog that has lost his trail is not simply carried along from one part of the hunting process to another by a succession of stimuli evoking simpler reflexes, but he explores about, seeking the trail.[6] Woodworth interprets this behavior as follows: "The mechanism for a consummatory reaction, having been set into activity by a suitable stimulus, acts as a drive operating other mechanisms, which give the preparatory reactions. Each preparatory reaction may be a response in part to some external stimulus, but it is facilitated by the drive towards a consummatory reaction. Not only are some reactions thus facilitated, but others which in other circumstances would be evoked by external stimuli are inhibited."[7] Again, Tolman, in describing a rat that runs a maze, writes: "It is to be observed that his running and searching activities persist *until food is reached*. . . . We do not know whether the rat in so persisting is 'conscious,' we do not know whether he 'feels' a 'purpose,' but we do know that given (1) the physiological condition of hunger and given (2) the objective conditions of the maze, the rat thus *persists until food is reached.*"[8]

In human action the nature of the expected-result becomes more complex. Not only are there new gamuts of anticipated consequences which one does not find in the biological world, but there is also the novel capacity to act in the light of these consequences. In the case of instruments and machines, we do the anticipating for them and arrange the different parts in reference to a common function; and animals act only as if they were "conscious" of the results towards which their efforts are directed. Human beings, however, are aware of the ends which they pursue, and this accompanying anticipation

[6] Woodworth, R. S., *Dynamic Psychology*, p. 41.

[7] *Ibid.*, pp. 41–42.

[8] Tolman, E. C., "Purpose and Cognition: The Determiners of Animal Behavior," *Psychological Review*, Vol. 32, 1925, pp. 285–286.

makes their actions more informed, imaginative, and creative. Ends become aims, and functions intentions. The expected-result, therefore, is not only a drive, but may also become a controlling, and regulating principle, or, using Professor Perry's expression, a "governing propensity." We refer to this new quality not to eulogize human nature, but to indicate the more inclusive meaning of the expected-result at the different levels of purposive action.

The unifying, the regulating principle, or the drive of the expected-result, however, should not be interpreted in vitalistic or in purely introspective terms. We need not dwell on this, as our whole effort is to present an observable definition of purpose. The common function of musical instruments, from drums to violins, or the common function of living beings, from amœba to man, is not a hidden "something," but is empirically determinable and verifiable by statistical laws. The drive of purposive action is not distinct from mechanism. Any series or number of mechanical objects may attain this quality if the objects are grouped in relation to a common result.

2. *Subordinate Acts.*—The expected-result, as has already been pointed out, is the major characteristic of purposive behavior; but for the accomplishment of the expected-result certain acts are selected, preserved, and repeated. In purposive activity, there are fundamentally two levels of action: the expected-result, which is the end of action, and the subordinate acts, which are the means for the attainment of the end. This distinction between two levels of action is common in human behavior. We desire or wish certain things as ends and select others as means. For indefinite ends we usually have an indefinite number of means, but as ends become definite the means become definite. The same distinction is made by psychologists in their description of animal behavior. Köhler, in his description of the behavior of his chimpanzees, points out that the connections between the animals and their objectives are established by sticks or other objects. Thus Nueva, failing in her attempts to get the bananas placed beyond her reach, after a stage of more or less prolonged, unconcerted efforts, suddenly "casts a look at the stick, ceases her moaning, seizes the stick, stretches it out of the cage, and succeeds, though clumsily, in drawing the bananas within arm's length."[9] DeCamp also, in his experiments with white rats, points out the selection of subordinate acts by the rats for a given goal. Of two paths leading to food, one being shorter, the rats choose the shorter.[10] As a matter of fact, all animal and human action, if not isolated, but conceived as part of a larger activity, may be considered as subordinate action.

The expected-result of an action is the selecting principle; but it

[9] Köhler, W., *The Mentality of Apes*, p. 33.

[10] DeCamp, J. E., "Relative Distance as a Tractor in the White Rats' Selection of a Path," *Psychobiology*, pp. 245–253.

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is worth noting that subordinate acts, in their turn, modify, change, and color the nature of the expected-result. Ends determine means, but means, in their turn, modify and shape ends. The kind of stones which are available for the construction of a building impose the nature of the architectural design; the toys given children make them play; and the machines furnished adults initiate them to build roads and cities. The oft-repeated assertion of the effects of machines on our civilization is another case in point. The distinction between the expected-result and subordinate acts, therefore, is a relative one. In actual behavior the two blend into each other and purpose becomes the whole behavior.

It is also necessary to point out that even if the relative utility of the two levels of action is admitted, there are, in any complex behavior, hierarchies of expected-results and subordinate acts. When ever we say our purpose is so and so, we often refer to what is most dominant in our attention at the moment. A careful analysis, however, would show a great complexity of ends and means. The business man who is hurrying to his office is evidently anxious to reach it at a specific time—that is his immediate objective; but this objective, in turn, is a means to other ends.

Finally, we may refer to the function of intelligence or reasoning in the selection of the subordinate acts. Intelligence experiments in the realm of thought and imagination with the application of a number of subordinate acts, without incurring the disasters of actual experiments. Like Leibniz's God, it has the capacity to consider all possibilities and to select for actuality the best possible. Intelligence thus economizes our time and efforts in the attainment of ends.[11]

3. *Future Reference.*—The reference to the future is the third characteristic of our definition of purpose. The expected-result has not been accomplished; it is an event which will occur in the future. The commonest language of purpose, such as "in hope of," "with a view to," "in order to," "lest," are prospective expressions. Any interpretation of purpose which does not consider this temporal characteristic fails to do justice to one of the most important aspects of purpose.

On the futurity of purpose there are various theories. The popular notion tends to consider purpose as a future cause which determines the present action. This view, however, commits the fallacy of placing the effect before the cause. Other theories, such as the Kantian and the Absolute Idealistic, depreciate the temporal aspect of purpose. Purpose, in these theories, is either relegated with God, freedom, and immortality to the noumenal world, or it is characterized *sub specie æternitatis.* At the present we do not intend to

[11] Mach, E., *Erkenntnis und Irrtum,* especially the section "Über gedankenexperimente," and also Rignano, E., *The Psychology of Reasoning,* ch. IV.

analyze these non-temporal notions of purpose. It is sufficient to point out that empirically there is a certain temporal relation, which needs to be made clear.

The temporal characteristic of purposive behavior may be described in terms of the correlation of the subordinate acts with the expected-result. In purposive behavior subordinate acts are for the sake of the anticipated consequence, and, therefore, they should not be interpreted as hit or miss, or random occurrences. The subordinate acts are correlated with the end-result, so that they present an internal and progressive relation of the present activity with future happenings. A lawyer who is defending a plaintiff has a series of statements ready in advance. Every argument and every bit of evidence is arranged in serial order for the accomplishment of a future result, viz., the persuasion of the jury in favor of his client. Or, again, a hostess who is waiting for her guests has carefully planned how to welcome them, how to serve the refreshments in order, and how to entertain the guests throughout the evening. Her plan presents a definite temporal succession which is expected to occur in a certain order.

Though in all types of purpose one does not find such a clear and orderly arrangement of acts, there is always a certain direction or a reference to future results. The hunting dog in his attempts to find the trail, and the rat in his struggle to get out of the maze, make many random movements; but these processes considered as a whole present congruence between the various acts and the future results. Without this relation it would be impossible to determine which acts are successful and which are not. Purposive action is loaded; actions do not just happen. There is an implicit organization which becomes explicit in the process of accomplishment. In well-thought-out plans, and under normal conditions, each act is smoothly correlated with the next; in complex, confusing purposes and under changing conditions these relations become tentative, experimental, and delayed.

4. *Uncertainty.*—Since purpose is a common tendency of a group or class, the results of purposive activity can generally be anticipated. There are, however, always individual variations and exceptions. The expected-result occurs usually, but not always. Even in cases where the occurrence of the anticipated consequence is much higher than its non-occurrence, it is folly not to entertain the possibility of the defeat of one's prediction.

In this respect, the contrast between the laws of physical science and the laws of purposive activity is interesting to distinguish. Laws of physical science, at least methodologically, admit no exceptions. If exceptions occur within the limits of a given law, then the

law is revised and new limits are found within which no exceptions occur. Laws of purpose, however, are statements of averages, and so lack the rigor of natural laws.[12] They help us to determine the normal and give us the basis for probable results, but they never yield invariable relations. The fate of a specific car is full of the unforseeable and unpredictable. An accident may destroy it, or it may be superseded by a new invention. Or, again, no statistician, however exact he might be in his calculation, could predict with certainty whether we shall be successful or not in the purposes we pursue.

The uncertainty, or the chance element, of purposive processes, however, need not be considered merely a concept of ignorance. This view would make chance only subjective. But chance may also be considered as objective and definable. Whatever our ultimate metaphysical theory may be, the fact remains that within the limited universe of discourse, to which knowledge is restricted, the forthcoming result of the purposive action is uncertain. We express this uncertainty or doubt by the concept of chance which, objectively, means the resultant due to the collision of two independent sets of conditions. If we were to enlarge our universe of discourse to include the sets of conditions which were without, we might reduce certain chance factors to law; but the new circumscribed universe of discourse would have, in its turn, new chance factors.

Purposive systems, because of this factor of uncertainty and chance, may be considered free. Freedom means, primarily, the capacity to maintain a given purpose in the changes and vicissitudes of circumstance. All purposive systems possess this capacity, though in varying degrees. The ship that weathers a storm and reaches her destination exhibits this capacity, though it be extrinsic to her; living beings and human beings exhibit the same capacity as an intrinsic quality by their adaptability to varying conditions. But by asserting the freedom of purposive beings we do not discard mechanism. We assume mechanism to be universal—that analytically every system is determined at every point. This is, of course, a belief, or a postulate, if you like, but a postulate which need not be denied to assert freedom. One might find the possible solution of this paradox if he did not consider all relations to be additive. Because distributively there is no curve in a wave nor melody in a song, does it follow that collectively they do not present these qualities? It is experience which has to show what relations are additive and what relations are non-additive.

In the present paper the discussion was limited to the meaning of purpose. The purpose of an act has been found to be the common

[12] There are, of course, current theories which attempt to identify the physical laws with purposive laws by considering the former as statistical.

tendency, or the expected-result, of that class of act. The characteristics of this definition have been shown to be the unifying and the regulating principle of the expected-result, the selection of the subordinate acts for the accomplishment of the anticipated consequence, the future reference, and, finally, the uncertainty of the accomplishment of the expected-result. The question of the applicability of purpose to life, to mind, or to other realms has not been raised. From our point of view this problem is not a controversial but primarily an experimental one, which is determinable by statistical laws, the experimental problem being whether in the results of a given group or class one can discern a common tendency.

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BOOK REVIEWS

Auguste Comte et la Science Economique. ROGER MAUDUIT. Paris: Félix Alcan. 1929. 292 pp.

Auguste Comte, to say most of it in three lines instead of three hundred pages, knew little about economics, criticized the dogmatic liberalism of his day, influenced it almost not at all, and contributed next to nothing constructive in the field of economic thought.

For the amply-documented demonstration of the above propositions, the reader is referred to Dr. Mauduit's leisurely and informing pages. If he consults them in search of light and leading in economic matters, his disappointment, as already more than hinted, will be complete. Comte's revivalist denunciations of the sins of Adam Smith and his followers have lost their power to move us nowadays. To the historian of philosophy, and particularly of Positivism, however, their interest is considerable. They shed a good deal of illumination upon Comte's peculiar blending of right-wing tactics with left-wing ideals, and how it came about.

As a young *Polytechnicien,* Auguste Comte first appears in the rôle of an enthusiastic liberal, an admirer of Adam Smith and J. B. Say, together with the heroes of the *"sublime insurrection"* of 1789. In Henri de Saint-Simon, whose secretary he became in 1818, Comte found a master who was also at that time liberal in his tendencies, but beginning to fall away from some of the articles of the faith in *laissez-faire.* Until the rupture of their relations in 1824, the two men simultaneously developed, under the influence of de Bonald and de Maistre, more and more in the direction of authoritarianism, although Comte never advocated a great degree of State interference in economic matters. While his master went

far in that direction, Comte retained to the very end of his career a remnant of his early liberalism in his firm belief concerning the industrial incompetence of public officials. This separation of economic and political spheres was easily accomplished, because in France, as Dr. Mauduit points out, the sources of liberalism in the two realms were entirely separate: economic liberalism springing mainly from the Physiocrats, who were politically anti-liberal; while political liberalism sprang from the *philosophes* of the eighteenth century, many of whom were indifferent about economic matters.

The break with Saint-Simon in 1824, occasioned largely by the elder man's impatience to commence the material reorganization of society before, Comte felt, the groundwork of intellectual reorganization had even been begun, brought about Comte's complete emotional alienation from the Saint-Simonians and their religio-economic efforts at social reform. Thus at the beginning of his "first career" as the formulator of the Positivist system, Comte's mind was turned violently away from socialism, both by this personal quarrel and by his own proud intellectual ambitions in the direction of the organization of the sciences. When, later on, he was himself to attempt this same material reorganization of society through the Religion of Humanity, it was with the spectacle of the collapse of Saint-Simonism before his eyes, so that he found such socialism too Utopian and *Etatiste,* even though unchecked individualism pleased him no better.

During this "second career" the nature of the laws of social conduct (including the economic) became an increasingly embarrassing question. How was the scientific high priest of humanity to continue to insist upon the inexorable rigidity of such laws, and at the same time to exhort the faithful to redoubled efforts in observing them? Orthodox Marxism has since encountered a similar dilemma. Dr. Mauduit shows how Comte went through a number of stages in dealing with the problem.

At first, like Saint-Simon, he held all scientific laws to be physical or quasi-physical, based ultimately upon Newton's single principle of gravitation. Later he recognized two kinds of laws, —those of the inorganic world, rigid and orderly; and those of the organic world, more variable and admitting of progress. Still later he began to exalt the variable laws as the supreme type, until suppleness, and not rigidity, became the hallmark of the highest laws of science. The final result was that Comte, in his anxiety to include in his new system both the rigidity needed for his dogmas and the indeterminism demanded by his evangel, compromised hopelessly his conception of scientific law in general.

Comte's ignorance of economic writings, to say nothing of the economic data themselves, is revealed by Dr. Mauduit as hardly less than scandalous for a man who wrote so freely upon social questions. While under Saint-Simon's influence, he had read some of Adam Smith, Dunoyer (both later canonized in the Positivist Calendar), and J. B. Say, but of the Physiocrats he knew astonishingly little. As for the facts themselves, the author ironically remarks, Comte "never attempted to study any particular problem among those which stirred his generation; he always considered economics from a very elevated point of view, which is, no doubt, the attitude of the true philosopher" (p. 70).

Comte's charges against the economic theories of his day, as listed by the author, amount to three primary accusations, together with a number of secondary complaints. (1) Political economy is metaphysical, abstract, absolute, deductive, and yet anarchical; when it ought to be positive, concrete, relative, inductive, and yet authoritarian. (2) Political economy is an isolated science, when it ought to form a part of the organic whole or "Consensus" of knowledge culminating in *sociologie*. (3) Political economists are not sufficiently interested in social disorders, having deceived themselves into an optimism which they consider justified by the supposedly automatic character of economic laws. The minor complaints concern an alleged confusion, by economists, of science with art; and the matter of the notorious obscurity of economic technical terms.

Dr. Mauduit feels that the first two of the main charges, at least, were valid against the dogmatic liberalism of the times, with its *homo œconomicus* and its chronic neglect of observed facts. He also seems to think that Comte's attacks have done some good, because economists have been improving in these respects during the last century. It is hardly necessary to point out the *post hoc* character of such reasoning, in view of the multitude of conspiring causes. It may be, as Dr. Mauduit hopefully concludes, that "little by little the ideas dear to Auguste Comte impose themselves on the minds of all . . . and political economy will . . . some day, as Comte said, cease to be a science of lawyers and become a science of true savants." But, it should be added, if this is happening, or is about to happen, comparatively little credit, either for the ideas or for their adoption, belongs to Auguste Comte.

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The History of Psychology. W. B. PILLSBURY. New York: W. W. Norton and Company. 1929. Pp. 326.

An Historical Introduction to Modern Psychology. GARDNER MURPHY. New York: Harcourt, Brace and Company. 1929. Pp. xvii + 470.

Whoever is inclined to increase the number of catch-concepts to distinguish psychological types might add to the tough- and tender-minded philosopher, and the introverted and extroverted man of the street, the insular and continental scientist. The insular-minded among the scientists are those who strive only to "know more and more about less and less," while the continental scholar sees his own work set in a perspective covering both time and place. It is the continental-minded scientist who knows history.

Probably no one would disagree that the student of science should be well acquainted with the work of both his contemporaries and predecessors. A scientific perspective informs us not only of the origin and development of ideas with which we work, but also lends appreciation with regard to their significance and value. One might add, too, that perhaps in psychology more than in any other field, is such an overview desirable. It is probably the appreciation of this fact that accounts for the recent quickening of the historical pen among psychologists.

In the two volumes before us we have two markedly different surveys of the psychological domain. The contents of Professor Pillsbury's volume consist of a very clear and exceedingly simple presentation of psychological ideas. His method is predominantly biographical; that is, the author calls the roll of eminent men and briefly states their psychological doctrines. While discussing such contemporary movements as center around the hormic, *gestalt,* and behavioristic conceptions he, of course, stresses doctrines and schools. From this volume the student may gather a fairly general view of the entire psychological panorama as it enrolls before him, but no sub-surface knowledge of the problems or principles of psychology. Although the book is obviously addressed to a popular audience, one is still constrained to ask whether it was Havelock Ellis who translated Helmholtz's *Sensations of Tone,* and if Wundt was discouraged from going into physiology because Helmholtz thought he did not know enough mathematics.

The work of Professor Murphy is not only, as the name aptly suggests, an introduction to psychology from an historical standpoint, but also a *vade mecum* for the student who wants to study current psychological problems set in a perspectival background.

Of the three parts into which the author divides his book the first sketches the pre-experimental period. Here he traces out in

broad lines the psychological ideas of the seventeenth, eighteenth, and nineteenth centuries against their general intellectual background.

Part two is devoted to the development of distinctly experimental psychology from Weber to Wundt. It is a commendable quality of the present volume that while the author is strongly inclined to stress the experimental conquests of psychology he does not neglect to point out significant streams of non-experimental ideas. And so in this section Professor Murphy does ample justice to such writers as Spencer and Bain, although, paradoxically enough, Lewes, who was an experimentalist working on problems that are today the center of interest in physiological psychology, is not given a place in the chapter on British psychology. Again, one does not regret the author's straining the specified boundaries of this section by including in it a chapter on the psychiatry of Pinel, Charcot, and the Hypnotic School. In the concluding chapter entitled "The Age of Wundt" that writer and his influence are evaluated and accorded great praise.

The contemporary scene is usefully surveyed in the third division. The material is organized under a variety of headings. Some chapters the author devotes to a summary of experimental studies on such topics as memory, the thought processes, acquisition of skill, and physiological psychology. Others treat prominent movements like the functional and structural types of psychology, behaviorism, and psychoanalysis, while still others describe the developments in such fields as child and social psychology, mental measurements, and personality. A short chapter is also devoted to the instinct doctrine. It is no depreciation of a fine work to record a certain sketchiness of treatment when all this material is handled in a little over two hundred pages.

The volume closes with a supplement in two chapters by Dr. Klüver on Contemporary German Psychology. In the first are treated the writings of those psychologists who lean toward natural science. Here Dr. Klüver sums up the personalistic psychology of Stern, the *gestalt* view, Krueger's developmental psychology, and the eidetic theory of Jaensch. The psychologists who incline toward cultural science are discussed in the second chapter, the work of Spranger and Jaspers being given special treatment.

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Abriss der Logistik. RUDOLF CARNAP. Vienna: Julius Springer. 1929. Pp. iv + 114.

The term "logistic" in the title has reference to the mathematical logic of Whitehead and Russell, and the book is an introduction to

their *Principia*. It is largely taken up with explanations of the meaning of the symbols, and as such is helpful. Still more helpful are the bibliographical references to points under debate. The English-speaking reader who can make out the symbols in this book can probably get along just as easily with the *Principia* direct, though this has the advantage of brevity. The index gives some rather useful help in the matter of equivalences of German and English terms. There is a section of practical applications, which is largely concerned with finding systems of postulates in various subject-matters. The author distinguishes neatly between systems which start with more or less well-known concepts, and systems of more generalized sort, whose fundamental entities are defined only by the postulates in which they occur. The value of a symbolism as an aid in clarifying postulates is undoubtedly great, though whether *this* symbolism is the best is a further question. The chief use of the book will undoubtedly be to bring German and English research along these lines closer together.

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JOURNALS AND NEW BOOKS

Bulletin de la Société française de Philosophie. 29e Année, No. 3. Les sentiments; regulations de l'action. Thèse: Pierre Janet. Discussion: Xavier Léon, D. Parodi, D. Roustan.

Fite, Warner: The Living Mind. Essays on the Significance of Consciousness. New York: Lincoln MacVeagh. The Dial Press. 1930. ix + 317 pp. $3.50.

Hocking, William Ernest: Types of Philosophy. New York: Chas. Scribner's Sons. 1929. xv + 462 pp. $2.50.

Hope, Richard: The Book of Diogenes Laertius. Its Spirit and Its Method. New York: Columbia University Press. 1930. xiv + 241 pp. $3.50.

Macchioro, Vittorio: Roma Capta. Saggio intorno alla religione romana. (Biblioteca Storica Principato. Diretta da Pietro Egidi, X.) Messina: G. Principato. 260 pp. 20 lire.

Olgiati, Francesco: Il Significato Storico di Leibniz. (Pubblicazioni della Università Cattolica del Sacro Cuore. Scienze Filosofiche. Vol. XIV.) Milano: Società Editrice "Vita e Pensiero." 252 pp.

Remmers, H. H., and Brandenburg, G. C.: A Syllabus Work-Book for a Two-level Plan of Instruction in Elementary Psychology. (41 Lessons Designed to Introduce the Beginning Student to

the Concepts, Principles, and Methods of Psychology.) New York: Macmillan Co. 1930. vii + 110 pp. $1.80.

Vaughan, Richard M.: The Significance of Personality. New York: Macmillan Co. 1930. viii + 302 pp. $2.50.

Warbeke, John M.: The Searching Mind of Greece. New York: F. S. Crofts & Co. 1930. xii + 464 pp. $5.00.

Watson, Goodwin, and Spence, Ralph B.: Educational Problems for Psychological Study. New York: Macmillan Co. 1930. xii + 352 pp. $1.80.

Farges, Jacques: Les Idées Morales et Religieuses de Méthode d'Olympe. Contribution à l'étude des rapports du Christianisme et de l'Hellénisme à la fin du troisième siècle. (Bibliothèque des Archives de Philosophie.) Paris: Gabriel Beauchesne. 1929. xvi + 266 pp.

Farges, Jacques: Méthode d'Olympe du Libre Arbitre. Traduction. Precédée d'une Introduction sur les questions de l'origine du monde, du libre arbitre et du problème du mal dans la pensée grecque, judaïque et chrétienne avant Méthode. (Bibliothèque des Archives de Philosophie.) Paris: Gabriel Beauchesne. 1929. xv + 184 pp.

Freund, Ludwig: Am Ende der Philosophie. Ein Kritisches Wort an die Zeit und ihre Philosophen. München: Ernest Reinhardt. 178 pp. 6.50 M.

Hamburger, Leo: Die Religion in ihrer dogmatischen und ihrer reinen Form. Versuch einer Grundlegung der Religionsphilosophie. München: Ernest Reinhardt. 1930. 170 pp. 7.80 M.

NOTES AND NEWS

We print below the program of the meetings of the Philosophical Union of the University of California, given during the spring semester, 1930. The title of the series is "Studies in the Problem of Relations."

I. January 31. "An Historical Sketch of the Problem of Relations." ..... *D. S. Mackay*
II. February 14. "The Question of Priority." .. *J. Loewenberg*
III. February 28. "Categories." ..... *S. C. Pepper*
IV. March 14. "The Nature of Geometrical Relations." *V. F. Lenzen*
V. March 28. "Implication." ..... *D. W. Prall*
VI. April 11. "Whitehead's Theory of Relations." *Paul Marhenke*
VII. April 25. "The Relation between Form and Process." *G. P. Adams*

The first volume of the *Encyclopædia of the Social Sciences* was published by Macmillan Company, February 1. The editor-in-chief is Professor Edwin R. A. Seligman; Dr. Alvin Johnson is associate editor; Professor John Dewey is the advisory editor for philosophy. The articles in alphabetical succession are preceded by two general introductions. The first is a series of articles on "The Development of Social Thought and Institutions," beginning with "Greek Culture and Thought (by W. L. Westermann), and concluding with an article on "War and Reorientation" (by the editorial staff). The second is a series of articles on "The Social Sciences as Disciplines" among the various nations today. These introductory articles comprise about half the first volume; the second half contains articles from Aaronson to Allegiance, inclusive. The work is to include fifteen volumes, of which three will probably be published each year. The price of the first volume is $7.50.

We quote from the preface of the editor: "In the making of the Encyclopædia we have three purposes in mind. In the first place it is intended to provide for the scholar a synopsis of the progress that has been made in the various fields of social science in the broadest sense of the term. The student of any particular science should not only find here factual and methodological information of value, but will also have his attention called, perhaps in a hitherto unusual way, to the relation of his own science to the other disciplines involved. . . .

"Secondly, the Encyclopædia will, it is hoped, appeal to a much more numerous class which for lack of a better term might be called the intelligentsia in the various countries. It ought to furnish an assemblage or repository of facts and principles which will subserve the interests of all those who are keeping abreast of recent investigation and accomplishment. It is for this reason that we have made every effort to keep the articles free from all scientific jargon.

"Finally, amid the welter and confusion of modern thought, it has been our hope that the Encyclopædia would constitute a center of authoritative knowledge for the creation of a sounder and more informed public opinion on the major questions which lie at the foundation of social progress and world development."